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ELECTROCOAT PROCESS FOR NON-CHROMATE PRIMERS IN DOD MANUFACTURING

Project Number: WP-201010

ASETSDefense
San Diego, CA
August 29th, 2012

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Technical Approach



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Task 1

- **Laboratory validation**

- Test to MIL-PRF-23377 and MIL-PRF-32239.
- *Goal: Electrocoat to meet MIL specifications and to equal performance of qualified spray primer.*

Task 2

- **Tank Installation at Military Depot**

- Pilot tank to demonstrate electrocoat application
- Application on aircraft parts

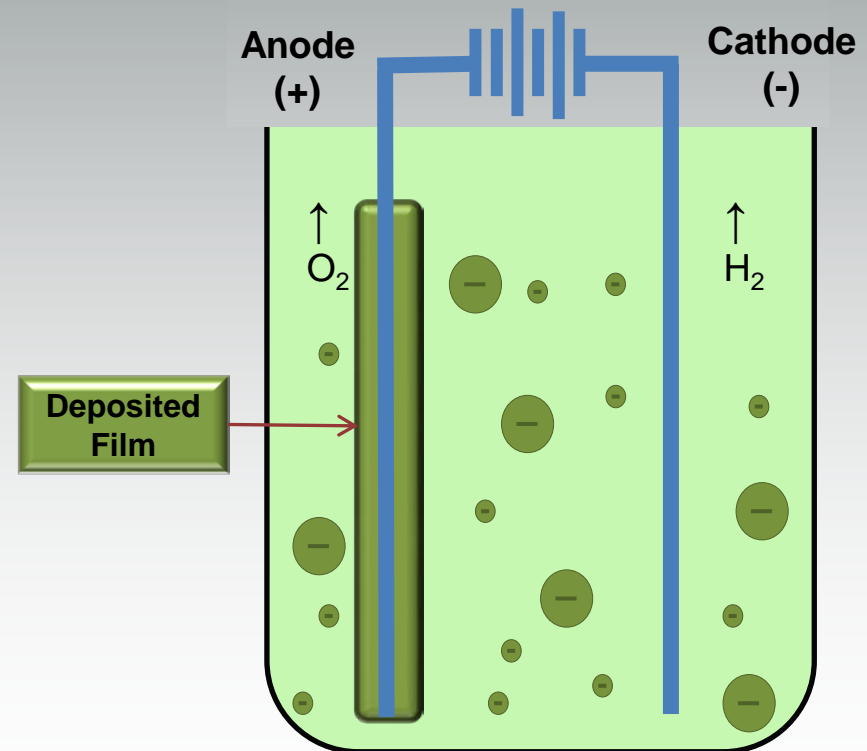
Task 3

- **Track performance relative to qualified controls**

- Field performance on military aircraft
- Determine life cycle benefits

An application method which uses direct electrical current to deposit the coating

- Waterborne coating
- Chromium-free (no heavy metals)
- Lower temperature cure:
30 minutes metal at 200° F
- Chemistry and cure requirements are uniquely suited for aerospace aluminum



Electrocoat Basics

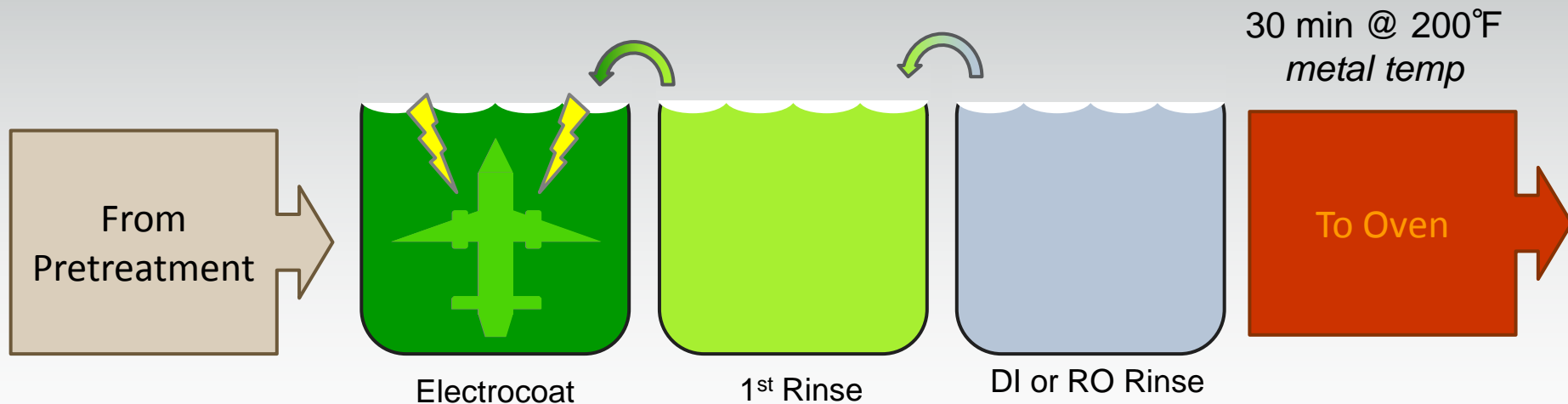


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The electrocoat system- Four stages:

- Electrocoat tank- primer application
- Two rinse tanks
- Oven (thermal cure)

Ready to fly



Electrocoat Benefits



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Productivity & Efficiency

- Virtually 100% materials utilization
- Immediate part handling after thermal cure (30 minutes metal @ 200 °F)
 - *Do not have “dry to touch”, “dry to tape”, “dry to fly” restrictions*

Application & Performance

- Uniform film across entire surface including recessed areas and complex shapes
- Excellent barrier / corrosion resistance properties

Benefits of Electrocoat



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Environmental, Health, and Safety Considerations

- Aqueous based
- Minimal waste discharge- closed loop process
- Minimal exposure of workers to coating components

VOC (EPA Method 24)

Ecoat	~260 g/ L
NC spray primer	340 g/ L
Cr spray primer #1	350 g/ L
Cr spray primer #2	340 g/ L

Task 1- Laboratory Validation



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- 2024 and 7075 aluminum alloys
- Four surface treatments
 - Cr(IV) Alodine 1200s (NAVAIR and PPG applied)
 - Sulfuric Acid Anodize (Type II) with dichromate seal
 - TCP
 - Prekote
- Comparison of five primers
 - Ecoat #1 and Ecoat #2 with two levels of corrosion inhibitor
 - MIL-PRF-23377N Cr-free spray primer
 - MIL-PRF-23377C Solvent Cr spray primer
 - MIL-PRF-85582C Water Cr spray primer
- Primer-only and with MIL-PRF-85285 Type I Gloss white topcoat

- Corrosion
 - **B117 Neutral salt spray**
 - **Filiform**
 - SO₂ salt fog
 - GM9540P
 - Beach Exposure (Kennedy Space Center)
 - Galvanic assemblies
 - Neutral salt spray
 - SO₂ salt fog
 - Beach Exposure

Performance Tests



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- Fluid Resistance
 - MIL-PRF-23699 lubricating oil
 - MIL-PRF-83282 hydraulic fluid
 - JP-8 + 100 jet fuel
 - Skydrol LD-4
 - Water
 - JP-5 jet fuel
- Adhesion
 - Wet
 - Dry
- Flexibility
 - Mandrel bend
 - GE impact

Results summary



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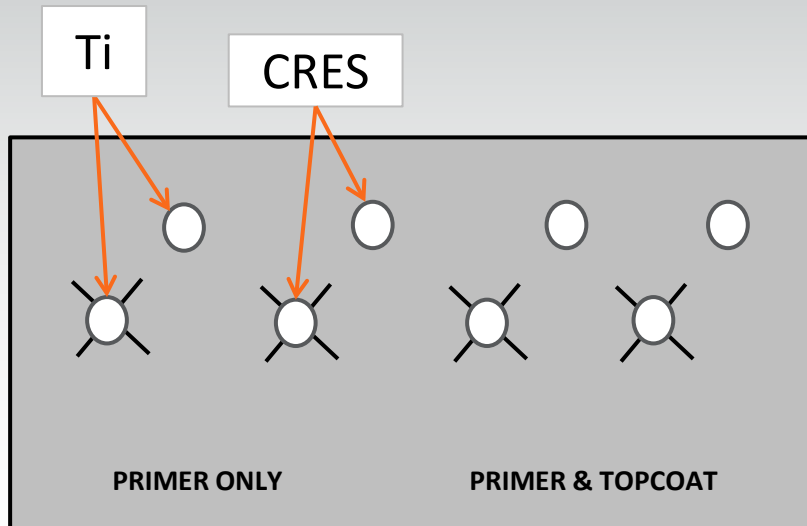
Test	Comments	Meets specifications
Salt spray	Better than/ equal to NC spray primer	✓
Filiform	Better than/ equal to Cr spray primer	✓
9540P	Better than/ equal to Cr spray primer	NR
SO ₂	Equal to controls	NR
Flexibility	Equal to controls	✓
Wet/ Dry Adhesion	Better than/ equal to controls	✓
Impact	Equal to controls	✓
Fluids Resistance	Equal to controls	✓
Water Resistance	Equal to controls	✓
Exposure Galvanic	Equal to controls	NR
Salt spray Galvanic	Mixed results	NR
SO ₂ Galvanic	Mixed results	NR

Results summary- Galvanic assemblies



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- AA2024-T3 & AA7075-T6
- Alodine 1200s, TCP, Prekote
- Testing:
 - ASTM B117 (500 hrs/3 weeks)
 - ASTM G85.A4 (336 hrs/2 weeks)
 - Beach exposure (still in testing- 9 months)



Results summary- Galvanic assemblies



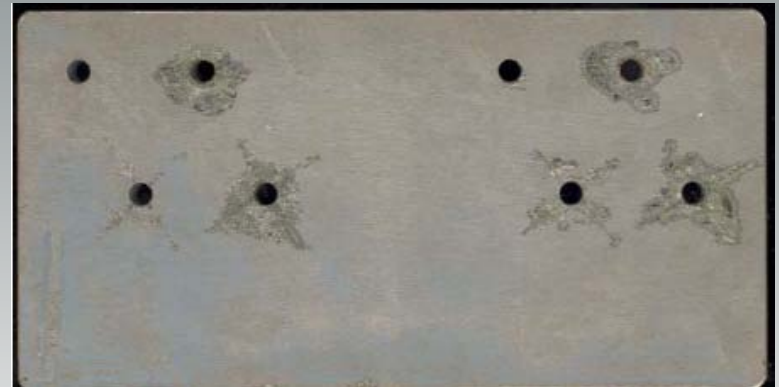
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- Corrosion testing- 3 weeks SO_2 (ASTM G85. Annex 4)

Ecoat

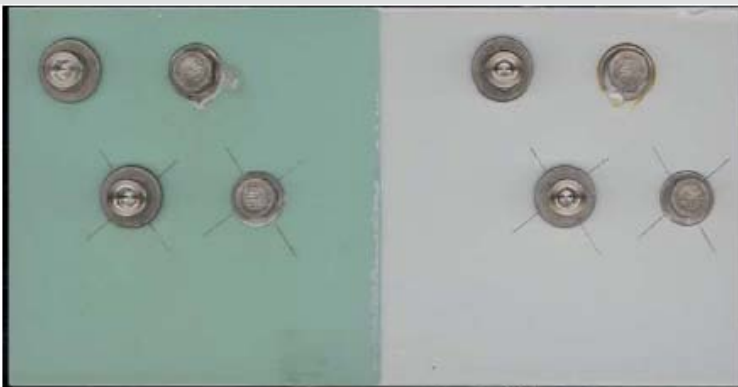


(As-is)



(After stripping)

NC Spray
Primer



Results summary- Galvanic assemblies



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Corrosion mechanism different between Electrocoat and spray primers

- Electrocoat has larger area of blistering; all surface corrosion
- Spray primers have more localized, but deeper corrosion

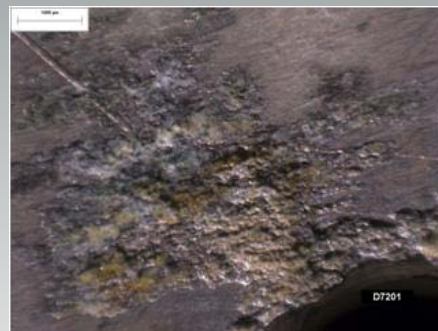
Scribe
near
fastener
hole



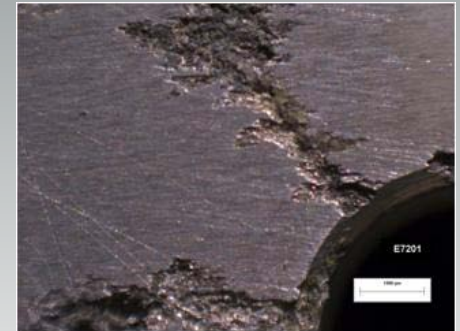
Residual coating



Ecoat



Cr spray primer



NC spray primer

Task 2- Tank installation at Military Depot



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- Potential parts



Task 2- Tank installation at Military Depot (Option 1)

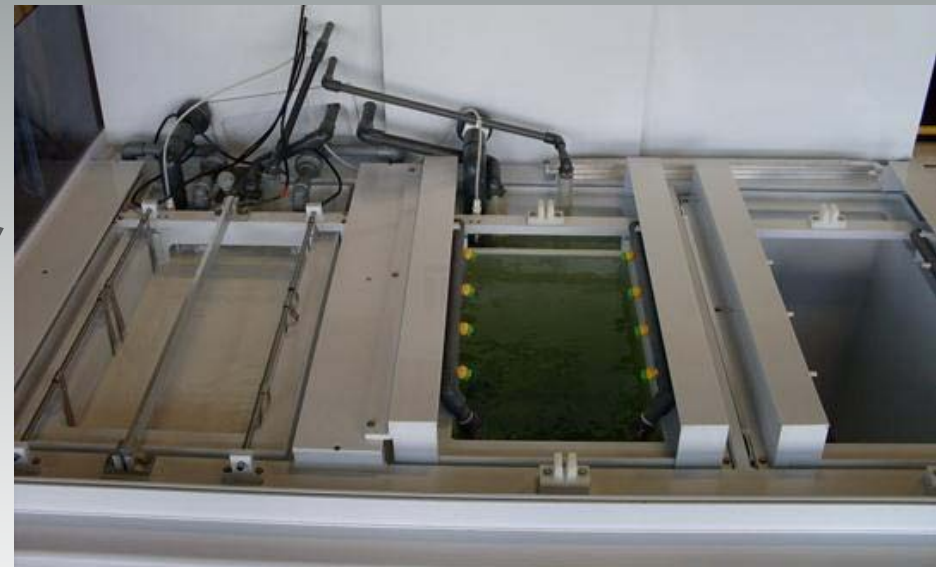


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- Technology demonstration using 100 gallon, self-contained electrocoat system



Top View



Tank 1
Electrocoat

Tank 2
Permeate
Rinse

Tank 3
Final DI
Rinse

Task 2- Tank installation at Military Depot (Option 2)



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- Utilization/ modification of existing equipment



~ 200 gallon tanks



~ 2000 gallon
tanks



Project Team



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